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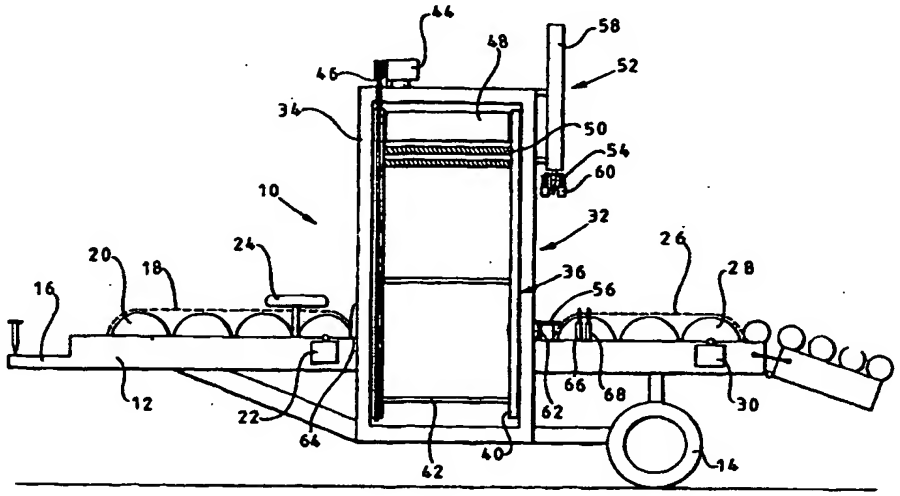

(57) Abstract

A bale wrapping machine comprises a wrapping head (48, 50) for supplying wrapping strip, means (36) for orbiting the head (48, 50) around a bale to wind said strip around the bale, and means (18, 26) for generating relative movement of the bale and the orbit of the head (48, 50) parallel to the axis of the orbit to wrap the length of the bale. The wrapping head (48, 50) is carried by a hollow cylindrical support (36) guided for rotation about its longitudinal axis, and includes at least one roller (50) for applying a predetermined tension to the strip material used to wrap the bale, in use.

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BALE WRAPPING MACHINE

Technical Field

This invention relates to apparatus for wrapping baled animal fodder, for example hay, in plastics film.

Baled fodder, in the form of "square" or "round" bales is commonly wrapped in plastics film after production in order to reduce the effect of the weather on the bales and/or to effect ensilagement.

Background Art

A known wrapping machines for wrapping round bales comprises a turntable arranged to be rotated about a generally vertical axis. A pair of rollers are mounted upon the turntable, the rollers being arranged to be rotated about their axes which extend generally horizontally, in use. A plurality of belts are entrained around the rollers, the belts being arranged to support the bale such that the longitudinal axis thereof is parallel to the longitudinal axes of the rollers. In use, as the turntable rotates about the vertical axis the rollers are caused to rotate resulting in rotation of the bale about its longitudinal axis and about a vertical axis perpendicular to its longitudinal axis. Adjacent the turntable is mounted a support for a supply of plastics film arranged such that as the bale is rotated, the film is drawn from the supply and wrapped around the bale. One example of such apparatus is the P J Parmiter and Sons Limited TR76 wrapper.

Where a "square" bale is wrapped using the above described machine, rotation of the bale about its longitudinal axis is not uniform resulting in non-uniform wrapping of the bale. Further, the non-uniform rotation of

the bale results in the machine being subject to shock loadings during rotation of the bale, and hence the working life of the machine may be reduced.

It is an object of the invention to provide a bale wrapping machine capable of wrapping "square" bales, particularly but not exclusively "large" square bales, in which the above described disadvantages are reduced.

Disclosure of Invention

According to the present invention there is provided a bale wrapping machine comprising a wrapping head for supplying wrapping strip, means for orbiting the head around a bale to wind said strip around the bale, and means generating relative movement of the bale and the orbit of the head parallel to the axis of the orbit to wrap the length of the bale.

Preferably the wrapping head is carried by a hollow cylindrical support guided for rotation about its longitudinal axis.

Conveniently the wrapping head includes at least one roller for applying a predetermined tension to the strip material used to wrap the bale, in use. The machine preferably further includes means for reducing the tension when wrapping the ends of the bale, in use.

The means for generating relative movement of the bale and said orbit preferably comprises first and second aligned but spaced conveyors, the first conveyor preferably being arranged to feed the bale into a first end of said cylindrical support, and the second conveyor being arranged to withdraw the bale from a second end of the support.

Preferably, the bale wrapping machine further comprises means for cutting the strip material used to wrap the bale. Desirably said means for cutting incorporates means for holding the strip material.

The means for cutting and holding the material preferably comprises a blade and an arm slidably mounted thereon and biased towards a position in which the arm extends below the cutting edge of the blade, the blade being reciprocable between a lowered position in which it contacts a crimping pad to effect cutting of the material, the arm engaging with the crimping pad to hold the material, and a raised position in which the material held between the arm and the crimping pad is released.

The blade is preferably moved between its lowered and raised positions by means of an hydraulic ram.

The bale wrapping machine preferably further comprises means for adjusting the angle of the wrapping head with respect to the axis of the orbit when wrapping the ends of the bale, in use, said means preferably comprising a mechanically or hydraulically operated extensible linkage arrangement.

Brief Description of Drawings

The invention will further be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic side view of a bale wrapping machine according to an embodiment of the invention; and

Figure 2 is a diagrammatic front view of part of the bale wrapping machine of Figure 1.

Best Mode for Carrying Out the Invention

The bale wrapping machine 10 illustrated in Figures 1 and 2 comprises a support frame 12 fabricated from steel tube, which is mounted upon wheels 14 and is arranged to be towed behind a baling machine, for producing "square" bales, by means of a draw-bar 16 provided at one end thereof. The baling machine may be a self powered unit or may in turn be towed behind a tractor such that, in use, as the baling machine produces bales, the bales are released onto the bale wrapping machine 10 where the bales are wrapped in plastics film and are then deposited on the ground.

A front end of the support frame 12 carries a first conveyor belt 18 which is entrained over four rollers 20 which extends widthwise of the support frame 12, one of the rollers 20 being arranged to be driven by an hydraulic motor 22 which is also carried by the support frame 12. A pair of guide arms 24 are provided one at each side of the first conveyor belt 18 to orientate the bale for wrapping. A second conveyor belt 26 is provided at the rear end of the support frame 12, the second conveyor belt 26 being entrained over three rollers 28 each of which extend widthwise of the support frame 12. One of the rollers 28 of the second conveyor belt 26 is driven by an hydraulic motor 30.

Provided between the first and second conveyor belts 18, 26 is a wrapping chamber 32. The wrapping chamber 32 comprises a steel support structure 34 within which is provided a cylindrical wrapping drum 36 supported for rotational movement upon two axially spaced sets

of four equiangularly spaced wheels 38 rotatably mounted on the support structure 34 and engaging with the outer periphery of the wrapping drum 36. The wrapping drum 36 comprises a pair of parallel steel rings 40 of equal diameter arranged coaxially and rigidly separated by means of a plurality of steel spacer bars 42. In order to support the wrapping drum 36 in a stable manner, four of the wheels 38 are arranged to engage with each of the steel rings 40 of the wrapping drum 36. It will be recognised that although a wrapping drum 36 of the above described nature is used in the illustrated embodiment, a number of variations are possible and the invention is not restricted to bale wrapping machines including the above described wrapping drum 36. The support structure 34 further carries an hydraulic motor 44 arranged to drive the wrapping drum 36 so as to rotate about its axis. The drive is transmitted to the wrapping drum 36 by means of a drive belt 46 engaging the outer periphery of one of the rings 40.

Supported at its end by each of the rings 40 is a roll 48 of plastics film and similarly supported, but parallel to the roll 48 is a tensioning roller 50, the plastics film extending over the tensioning roller 50.

A cut and hold device 52 is provided at the rear of the wrapping chamber 32, and comprises a blade 54 reciprocable between a lowered position in which it engages with a crimping pad 56 carried by the support frame 12, and a raised position. The bale wrapping machine 10 includes an hydraulic ram 58 arranged to move the blade 54 between its lowered and raised positions. The cut and hold device 52 further comprises an arm 60 which is slidable with respect to the blade 54 and is spring biased towards a position in which it extends below the cutting edge of the blade 54. A support roller 62 is carried by the support frame

12 in the vicinity of the cut and hold device 52 in order to support a wrapped or partially wrapped bale before it reaches the second conveyor 26.

Before use, plastics film is fed from the supply roll 48, over the tensioning roller 50 and is gripped between the arm 60 and crimping pad 56 of the cut and hold device 52. The hydraulic motors 22, 30, 44 are each connected to the hydraulic output of the tractor towing the baling machine, or any other suitable source.

In use, the hydraulic motors 22, 30 used to drive the first and second conveyor belts 18, 26 are operated continuously. On receiving a bale from the baling machine, the bale is carried to the wrapping chamber 32 by the first conveyor 18. When the front end of the bale reaches the wrapping chamber 32, a first switch 64 is activated thereby initiating operation of the hydraulic motor 44 for driving the drum 36.

Rotation of the wrapping drum 36 whilst the bale extends therein results in the plastics film being wrapped around the bale, the end of the plastics film being trapped between the arm 60 and crimping pad 56 of the cut and hold device 52. When the front end of the bale has reached the rear end of the wrapping chamber 32 and is supported by the support roller 62, a second switch 66 is activated to cause retraction of the blade 54 and arm 60 of the cut and hold device 52 to permit the bale to pass onto the second conveyor 26.

A third switch 68 is provided in the vicinity of the second switch 66, the third switch 68 overriding the first switch 64 so that whilst a bale extends

over the third switch 68, the motor 44 for driving the wrapping drum 36 continues to operate.

Once the rear end of the bale has left the wrapping chamber 32, the third switch 68 is no longer activated and rotation of the wrapping drum 36 stops. A fourth switch 70 is then activated resulting in the lowering of the blade 54 and arm 60 to contact the crimping pad 56. As the arm 60 contacts the crimping pad 56, the plastics film caught therebetween is gripped tightly and the film is then cut by the continued lowering of the blade 54.

Once the film is cut, the bale is carried by the second conveyor 26 until it falls from the rear of the bale wrapping machine 10, the bale wrapping machine 10 then being ready to wrap the next bale, the cut end of the film already being caught between the arm 60 and crimping pad 56 of the cut and hold device 52 in readiness.

If desired, the bale wrapping machine 10 may include an angled region provided to the rear of the second conveyor 26 in order to control the movement of the wrapped bale to the ground rather than simply letting it fall, thereby reducing the risk of the wrapping splitting on impact with the ground.

Complete wrapping of the leading and trailing end faces of the bale depends to some extent upon the width of the wrapping film, and the tension in the film between the tensioning roller and the bale. It is believed that the efficiency of wrapping of the leading and trailing end faces may be improved by reducing the tension in the film during wrapping of the leading and trailing end regions of the bale, and such an

effect can be achieved by control over the speed of rotation of the tensioning roller in relation to the linear speed at which film is required to wrap the bale (which in turn is dependent upon the orbiting speed of the head and the dimensions of the bale). Such control may be automated by using sensors to detect when leading and trailing end regions of the bale are being wrapped or by the use of timing mechanisms initiated when wrapping of a bale commences. In a timing arrangement initially the tension would be reduced, and then after wrapping for a predetermined length of time, calculated in accordance with the linear speed of movement of the bale and the bale length, the tension would be increased while the length of the bale is being wrapped, and then decreased after a period of time sufficient for wrapping of the trailing end region of the bale to have commenced.

As an alternative to controlling the tensioning roll, the film dispensing arrangement may effect similar control over the speed of rotation of the film supply roll.

As an alternative to, or in conjunction with, variation of film tension it is believed that the efficiency of wrapping of the leading and trailing end faces can be improved by adjusting the angle at which film is supplied to the bale when wrapping the leading and trailing end regions. In order to effect such an adjustment the tensioning roll, or more preferably the whole of the wrapping head, is linked to the rings 40 by extensible linkage arrangements. The extensible linkage arrangements can be mechanically adjustable linkages, or hydraulically extensible devices, and are operated to displace the tensioning roller, or more preferably the whole of the wrapping head assembly, from the normal orientation (parallel to the direction of travel of the bale) when wrapping the leading

and trailing end regions. Thus when a leading end region of a bale is being wrapped the tensioning roll, or wrapping head, will be angled, by means of its linkages such that its end region presented towards the receiving conveyor 26 is disposed closer to the axis of rotation of the drum 36 than the opposite end of the wrapping head or tensioning roller. Similarly, when the longitudinal extent of the bale is being wrapped the wrapping head will have been moved, relative to the drum 36, such that its axis is parallel to the axis of rotation of the drum and when the bale has moved sufficiently far through the wrapping chamber that it is the trailing end region of the bale which is being wrapped then the angling of the wrapping head or tensioning roll will have been reversed so that the end region of the wrapping head or tensioning roll closest to the input conveyor 18 is closest to the axis of rotation of the drum.

Control over the angling of the wrapping head, or the tensioning roller thereof in relation to the region of the bale being wrapped, can be effected in exactly the same manner as described above in relation to the control of the wrapping tension.

The above described bale wrapping machine 10 is intended to be towed directly behind a baling machine. In an alternative embodiment, the bale wrapping machine 10 may be bolted to or form an integral part of a baling machine. In a further embodiment, the machine may be towed directly behind a tractor, and used after baling has been completed. In this case, the bale wrapping machine 10 requires a device for loading bales onto the first conveyor 18.

CLAIMS

1. A bale wrapping machine comprising a wrapping head for supplying wrapping strip and characterized by means for orbiting the head around a bale to wind said strip around the bale, and means for generating relative movement of the bale and the orbit of the head parallel to the axis of the orbit to wrap the length of the bale.

2. A bale wrapping machine as claimed in Claim 1, wherein the wrapping head is carried by a hollow cylindrical support guided for rotation about its longitudinal axis.

3. A bale wrapping machine as claimed in Claim 1 or Claim 2, wherein the wrapping head includes at least one roller for applying a predetermined tension to the strip material used to wrap the bale, in use.

4. A bale wrapping machine as claimed in Claim 3, further comprising means for reducing the tension of the strip material when wrapping the ends of the bale, in use.

5. A bale wrapping machine as claimed in any one of Claims 1 to 4, wherein the means for generating relative movement of the bale and said orbit comprises first and second aligned but spaced conveyors.

6. A bale wrapping machine as claimed in Claim 5, wherein the first conveyor is arranged to feed the bale into a first end of said cylindrical support, and the second conveyor is arranged to withdraw the bale from a second end of the support.

7. A bale wrapping machine as claimed in any one of the preceding claims, further comprising means for cutting the strip material used to wrap the bale.

8. A bale wrapping machine as claimed in Claim 7, wherein said means for cutting incorporates means for holding the strip material.

9. A bale wrapping machine as claimed in Claim 8, wherein the means for cutting and holding the material comprises a blade and an arm slidably mounted thereon and biased towards a position in which the arm extends below the cutting edge of the blade, the blade being reciprocable between a lowered position in which it contacts a crimping pad to effect cutting of the material, the arm engaging with the crimping pad to hold the material, and a raised position in which the material held between the arm and the crimping pad is released.

10. A bale wrapping machine as claimed in Claim 9, wherein the blade is moved between its lowered and raised positions by means of an hydraulic ram.

11. A bale wrapping machine as claimed in any one of the preceding claims, further comprising means for adjusting the angle of the wrapping head with respect to the axis of the orbit when wrapping the ends of the bale, in use.

12. A bale wrapping machine as claimed in Claim 11 when dependent, either directly or indirectly upon Claim 2, wherein the wrapping head is mounted upon the hollow cylindrical support by an

extensible linkage arrangement extensible to adjust the angle of the wrapping head.

13. A bale wrapping machine as claimed in Claim 12, wherein the extensible linkage arrangement comprises a mechanically adjustable linkage.

14. A bale wrapping machine as claimed in Claim 12, wherein the extensible linkage arrangement comprises a hydraulically extensible device.

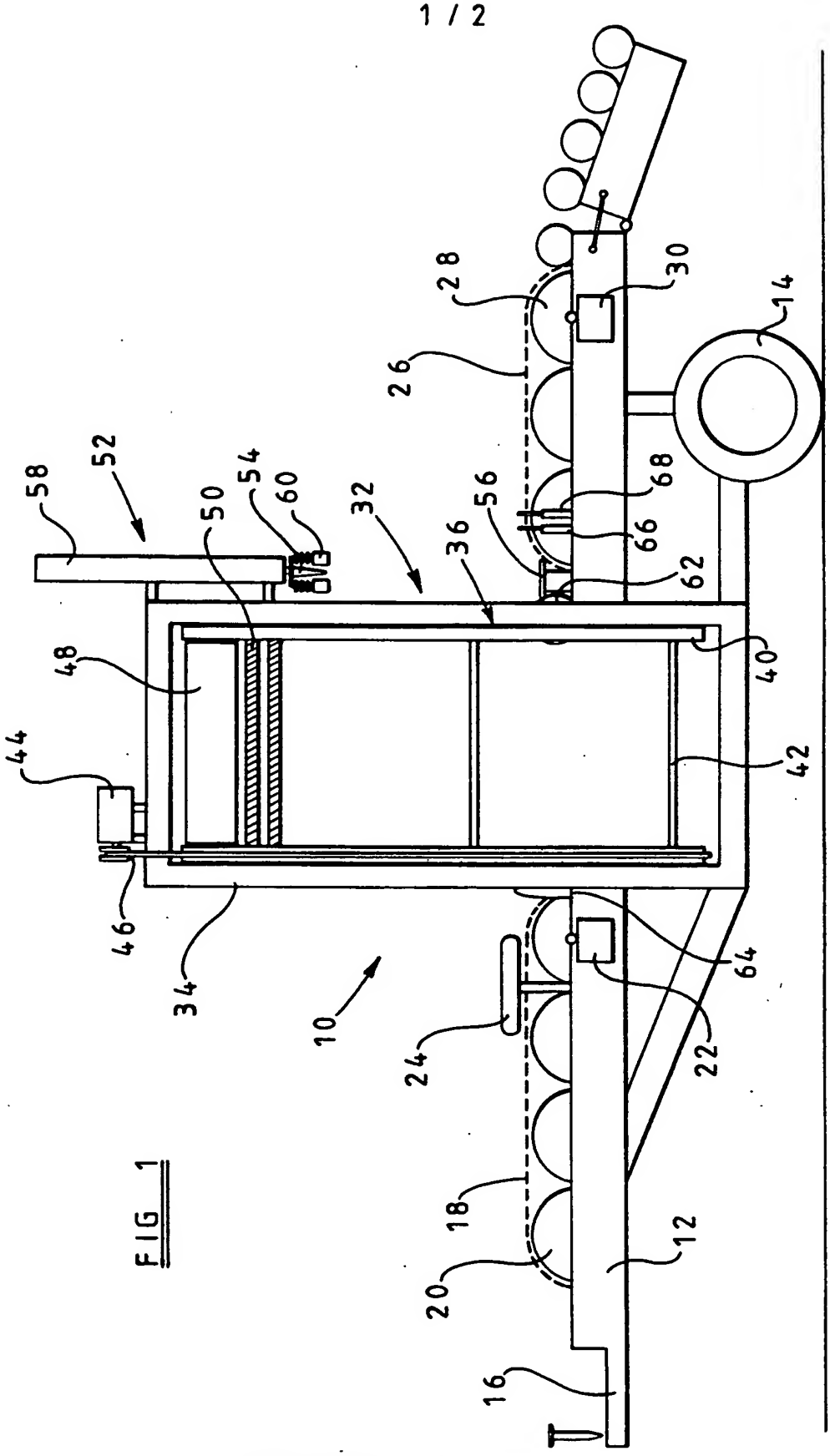
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FIG 1

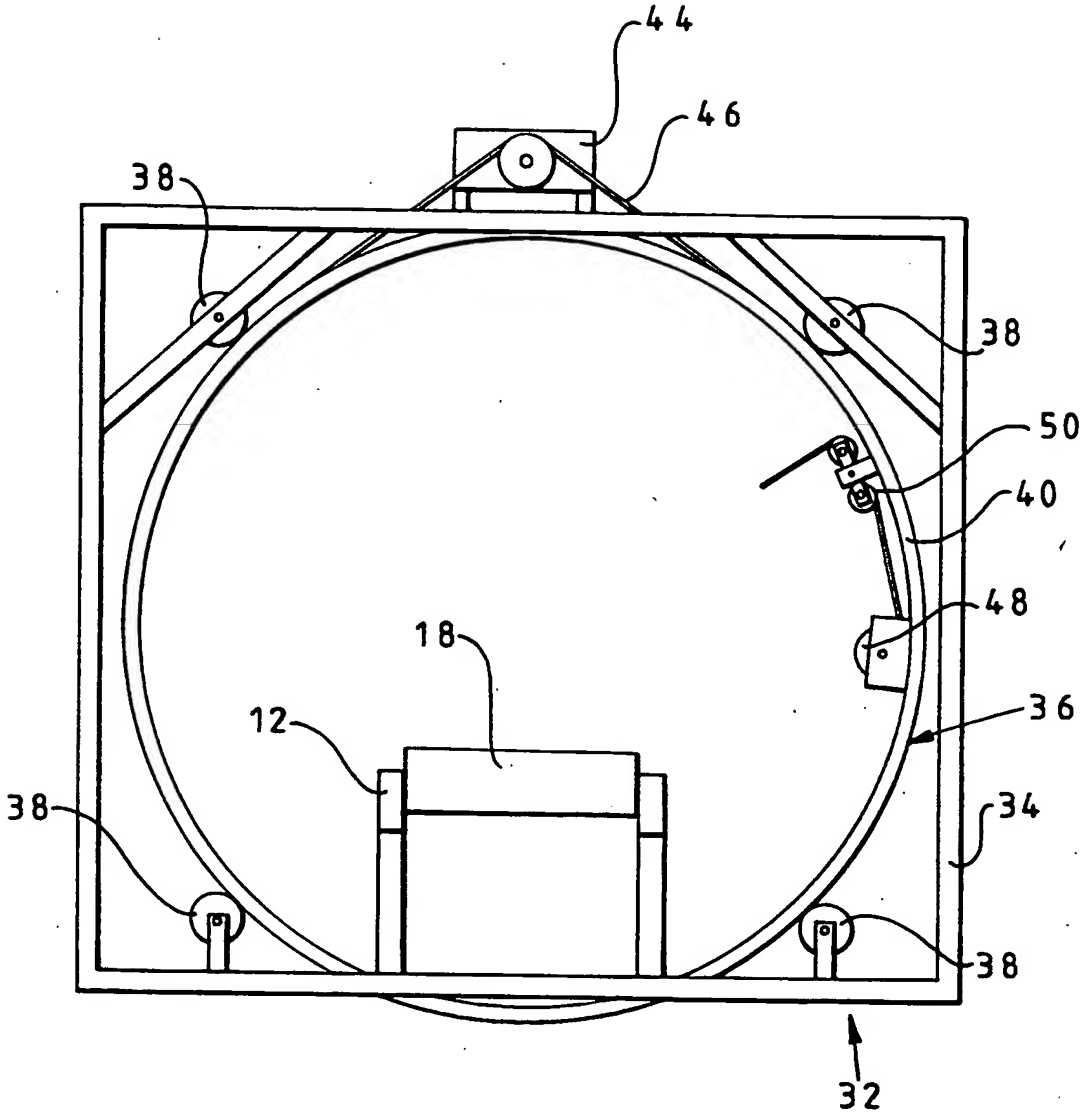

FIG 2

INTERNATIONAL SEARCH REPORT

Interr. al Application No
PCT/GB 94/01089

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 A01F15/07

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 5 A01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE,A,42 01 856 (BESTMANN) 11 June 1992 see column 2, line 5 - column 4, line 14; figures 1-3	1-3,5,6, 12
X	DE,A,40 21 307 (SCHENKE) 16 January 1992 see column 2, line 2 - line 44; figures 1,2	1,2,7-9
X	US,A,5 012 631 (DEWEY) 7 May 1991 see column 4, line 5 - column 8, line 33; figures 1-18	1-3,5,6
A	WO,A,93 07059 (KORSGAARD) 15 April 1993 see page 5, line 8 - page 12; figures 1-6	1-3,5,6
A	GB,A,2 192 172 (ANDERSON) 6 January 1988	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
DE-A-4201856	11-06-92	EP-A-	0553681	04-08-93
DE-A-4021307	16-01-92	NONE		
US-A-5012631	07-05-91	NONE		
WO-A-9307059	15-04-93	AU-A-	2697492	03-05-93
		DK-A-	36494	30-03-94
		EP-A-	0605665	13-07-94
GB-A-2192172	06-01-88	US-A-	4793124	27-12-88